

**WRITTEN FINDINGS OF THE
WASHINGTON STATE NOXIOUS WEED CONTROL BOARD
(October 1998)**

Scientific Name: *Chondrilla juncea* L.

Common Name: rush skeletonweed

Family: Asteraceae (Compositae)

Legal Status: Class B:
(a) regions 1, 2, 3, 5, 8, 9.
(b) Franklin County except T13N, R36E; and T14N, R36E.
(c) Adams County except those areas lying east of a line running north from Franklin County along the western boundary of R36E to State HWY 26 then north on Sage Rd. until it intersects Lee Rd., then due north until intersection with Providence Rd., then east to State HWY 261, then north along State HWY 261 to its intersection with Interstate 90, henceforth on a due north line to intersection with Bauman Rd., then north along Bauman Rd. to its terminus, the due north to the Lincoln County line.
(d) region 6 except that portion lying within Grant county that is southerly of State HWY 28, northerly of Interstate 90 and easterly of Grant County Rd. E Northwest.
(e) Stevens County north of T33N of region 4.
(f) Ferry and Pend Oreille Counties of region 4.
(g) Asotin County of region 10.
(h) Garfield and Columbia Counties south of HWY 12.
(i) Whitman County lying in Ranges 43 through 46 East of Townships 15 through 20 North; T14N, Ranges 44 through 46 East; and T13N, Ranges 45 and 46 East.

Description and Variation: Rush skeletonweed belongs to the chicory tribe of the sunflower family. This herbaceous perennial ranges from 1 to 4 feet tall, with a taproot reaching down 7 feet, or more. Seedlings have a long thin taproot. Rush skeletonweed overwinters as a rosette of hairless, basal leaves that are 2 to 5 inches long and ½ to 2 inches wide and broader at the tip. The lateral lobes point back toward the base - very similar to dandelion. The mature plant consists of a dark green, nearly leafless flowering stem, with many aerial branches. The basal rosette is absent at this stage. The stem and aerial branches support a few leaves, which are narrow and linear and mostly entire. A distinguishing characteristic of rush skeletonweed is the presence of coarse, downward pointing brown hairs near the base of the stem. The stems and roots of rush skeletonweed exude a white latex sap when cut. The flower heads, about ½" in diameter, grow along the stem in the leaf axil or at the branch tips, and they are found individually or in clusters of 2 to 5. Each flower head has 7-15 (usually 11) ray flowers, with yellow ligules resembling petals. These yellow ligules are strap shaped with small teeth across the blunt end. Mature, vigorous

plants can produce 1,500 flower heads, with the capability of producing 20,000 seeds. The immature seeds are greenish-white, and they gradually darken to a yellow-brown or olive-green in the 13-15 days it takes to mature. Seed color can be used as an indication of maturity, with light colored seeds showing low germination rates (Old 1981). Each seed has a pappus, which is capable of carrying seeds along wind currents up to 20 miles (Cuthbertson 1967 and Schirman and Robocker 1967 as cited in McLellan 1991).

There are hundreds of biotypes of rush skeletonweed, (Martin 1996) and they are sometimes differentiated by leaf morphology, height, branching patterns or flowering times. Three biotypes are known to exist in the Pacific Northwest (Boerboom 1993; Prather 1993). The tall, late flowering Spokane, WA biotype can reach 50 inches tall, is sparsely branched and it flowers in August. The short, early flowering Post Falls, ID biotype ranges from 25 to 35 inches tall, with extensive branching, and it flowers in mid-July. The short, early flowering Banks, ID biotype is very similar in appearance and flowering times, but this type is susceptible to *Puccinia* rust, a biological control agent (Boerboom 1993). Biotype forms in southern Australia are differentiated by leaf shape - narrowleaf, intermediate-leaf and broadleaf (Heap 1993; Cullen and Groves 1977 and Hull and Groves 1973 as cited in Chaboudez 1994). A recumbent form is known from Greece (Martin 1996).

Economic Importance:

Detrimental: Rush skeletonweed is a threat to irrigated lands of the Columbia Basin, to the sandy soils of dry land wheat areas (Old 1981), and it is a threat to rangelands.

Rangeland infestations impact the cattle industry when rush skeletonweed displaces native or beneficial forage species grazed by livestock and wildlife. Forage production is lowered when rush skeletonweed successfully outcompetes beneficial species for limited resources, particularly nitrogen. Often, the cost of herbicide control is not economical due to low productivity of the land (Sheley).

Rush skeletonweed spreads from rangeland to croplands by seed. Once established on roadsides adjacent to croplands, mechanical injury to the plant can produce shoots from any part of the main root, from the lateral roots, and from root fragments at least 4 feet deep (Old 1981). Once established in wheat-fallow systems, cultivation is the major factor of spread. Crop yields are also reduced as a result of rush skeleton-weed outcompeting grain for soil moisture and nitrogen. Grain harvest is difficult because of the wiry stems, and the latex sap of rush skeletonweed gums up harvesting machinery. In Australia, crop yields were reduced by 50-70%, with some fields later converted to rangeland.

Beneficial: Sheep graze the rosette and early flowering plant (Cuthbertson 1967 as cited in Sheley). Cattle will also graze the tips of flowering stems early in the season, before lignified stems grow (Daly 1935 as cited in McLellan 1991).

Habitat:

Rush skeletonweed prefers two soils types found in the Pacific Northwest: the sandy to gravely and well drained soils typical in the glacial lobe soils of Spokane, and the shallow soils over bedrock, typical in the channeled scablands. Roadside populations of rush skeletonweed are established when the seed is moved along transportation routes. Plant fragments can develop in areas not conducive to seedling establishment, with contaminated cultivation machinery responsible for the majority of this type of spread (Old 1981).

Precipitation can range from 10 to 40 inches per year. Winter temperatures range from areas with little to no frost, to areas with temperatures below -4 degrees F (Martin 1996).

Geographic Distribution:

Rush skeletonweed is native to Eurasia, where it is found from southern Russia to North Africa. It is also found from France and Portugal to Turkey and Iran (Emge 1977). Rush skeletonweed is from central Asia and the Mediterranean Basin of Europe. The Balkans are considered near the center of distribution (Old 1981).

History:

Rush skeletonweed was identified in the northeastern seaboard of the United States - Maryland, New York and West Virginia, during the 1870's. Rush skeletonweed was introduced to Australia prior to 1910 as a contaminant from European grapevine stock, and as a contaminant in fodder from the United States in 1914 (McLellan 1991). Rush skeletonweed was identified in 1918 in Australia, centered near New South Wales. It has since spread throughout the Australian wheat belt.

Rush skeletonweed was first identified in the Pacific Northwest from Spokane County, WA in 1938. In 1960, visiting Australian scientists interested in wheat production, noticed weedy populations in wastelands of eastern Washington. They relayed the impacts of rush skeletonweed on their homelands (Old 1981). Rush skeletonweed was discovered in Idaho and Oregon in the 1960's (Sheley; McLellan 1991), and in California in 1965 (McLellan 1991). Oregon traced the majority of their rush skeletonweed infestations to an 80 acre gravel pit (Old 1981). Rush skeletonweed continues to extend its range, with northern populations spreading into Western Canada and occupying grazing lands (Ceska 1997).

Worldwide, rush skeletonweed spread to Australia, Argentina, Italy, Lebanon, New Zealand, Portugal, Spain, the United States and the former Yugoslavia (Parsons and Cuthbertson 1992 as cited in Sheley).

Growth and Development:

In our region, the flowering time of rush skeletonweed depends on the biotype. The tall late flowering Spokane, WA biotype is predominant, and it flowers in August and lasts until frost (Boerboom 1993). Each flower head remains open for one day. The seeds mature, and are shed, in about 14 days. The pappus of each seed acts as a parachute, and seeds are commonly dispersed by wind.

The fall rains induce both seed germination and vegetative growth from rootstock, each producing an overwintering rosette of basal leaves. However, a 1996 field survey from the Okanogan Valley area of British Columbia reports the absence of these overwintering rosettes (Martin 1997). Seedlings are present in the fall and winter. The increasing day lengths of spring induce the flowering stem(s) to bolt, producing many aerial branches. Small leaves are sparsely found along the stems and branches. At this time, the rosette of basal leaves begins to wither and it later disappears when the plant is in flower. Photosynthesis takes place in the green stems (Martin 1996). The summer development of flower heads on a basically leafless stem with thin aerial branches gives the appearance of a “skeletonweed”. The flowering shoots die back in October or November.

Lateral roots can branch from the tap root, with the capability of spreading several feet and producing daughter rosettes, particularly in sandy and gravelly soils. Shoots develop from root buds found in the top 2-4 inches on the main root, and from buds found along surface lateral roots of undisturbed plants (Rosenthal et al. 1968 and Ross and Taylor 1935, as cited in Old 1981). However, when rush skeletonweed is mechanically injured, shoots can form from any part of the main root, from the lateral roots, and from root fragments at least 4 feet deep. Root fragment regeneration depths varied with fragment size and soil type, with sandy soils producing regeneration from greater depths than clay soils (Old 1981). 1 cm of a root section is capable of regeneration (Cuthbertson 1963 as cited in Erickson 1979). Root fragments are viable until they desiccate.

New populations establish when seeds from established infestations are carried to a suitable site that supports seedling growth. That mature plant then produces satellite plants - the daughter rosettes from lateral root formation. This potentially leads to colonization of an area by one rush skeletonweed plant.

Seeds, often carried on wind currents, land far from the original seed source. These individual plants evolve in isolation to form genetically distinct biotypes. Over 300 recognized biotypes are found in southern Europe (Martin 1996). Hybridization is rare, but random mutation may produce new strains of rush skeletonweed (Cuthbertson 1972 and Panetta and Dodd 1987a as cited in McLellan 1991).

Reproduction: Reproduction is by seed and vegetative growth. Rush skeletonweed is described as an herbaceous, somewhat long lived perennial, outside of its native range. In its native range, it is described as a biennial, or short lived perennial (Old 1981; Rees et al. 1996). Flowers are produced in the first year, and each plant can support flower buds, blooming flower heads and mature seed heads at the same time.

Rush skeletonweed is an obligate apomict - produces seed without fertilization. This self fertilization produces clones of the parent plant, resulting in the well-adapted biotypes that can dominate an infested area (Old 1981; Martin 1996). Depending on the plant biotype and the growing conditions, a mature plant can produce 1500 flower heads, each with (usually) 10-12 flowers. Each flower produces one seed. (Cheney, et al. 1981; Old 1981). 90% of seeds germinate. Viability of seeds is less than 18 months (Lee 1986 as cited in Martin 1996). Seed dormancy ranges from none to less than three weeks, depending on the biotype (Panetta 1988 as cited in McLellan 1991).

Vegetative spread is possible from shoot buds found along lateral roots, and from shoot buds found near the top of the main tap root. Vegetative spread is also possible when a root fragment, as deep as 4 feet down, is left in the ground. When the plant stem or root is mechanically injured, vegetative growth is initiated.

Response to Herbicide:

Different forms, or biotypes, of rush skeletonweed may affect the susceptibility rates of herbicides. Research continues (Heap 1993). Rush skeletonweed is a deep rooted, rhizomatous perennial, considered tolerant to herbicides (Prather 1993). Control with herbicides requires an aggressive follow-up program with repeated applications. Site specific conditions must be taken into consideration. Check rates and applications with the PNW Weed Control Handbook.

Treating plants less than 5 years old had a better response to herbicide application than older plants, because of the root system. Recent field trials indicate that late fall applications of Transline, after the first frost in November, showed 95% effective control rate. However, plants did show up 3-5 years later (Personal notes from 4/7/98 meeting).

Apply picloram to rosettes prior to or during bolting, from late fall to early spring. 2,4-D application is recommended on the rosette prior to or during bolting in the spring (William et al. 1998). 2,4-D at lower rates will suppress rush skeletonweed enough to allow harvest of grains, but the lower rates will not kill a perennial root system.

Application of nitrogen fertilizer reduces the density of rush skeletonweed (but increases the plant size) by increasing the competitiveness of beneficial plants. This method is effective in wheat and pasture lands with high moisture (Myers and Fitzsimon 1965 as cited in Sheley).

Response to Cultural Methods:

Using beneficial forage species for competition, will not suppress the dominance of rush skeletonweed. A more integrated approach using both plant competition and biological control agents often results in better control than either method used separately (Groves and Williams 1975 as cited in Prather 1993; Prather 1993). Continual grazing as a control method decreased the populations of rush skeletonweed when seed production was prevented, but rotational grazing increased the plant densities (Kohn and Cuthbertson 1975 as cited in McLellan 1991).

Response to Mechanical Methods:

Any mechanical damage to the plant stimulates new growth, often resulting in satellite plants. Root fragment regeneration depths varied with fragment size and soil type, with sandy soils producing regeneration from greater depths than clay soils. Cultivation as a control method can be considered on seedlings less than 36 days old, as they are unable to develop roots from root fragments (Old 1981).

Frequently mowing rush skeletonweed plants infested with and impacted by the gall mite (*Eriophyes chondrillae*) may decrease the rate of spread of this plant (McLellan 1991).

Biocontrol Potentials:

The biological control agents are very specific to biotype.

In Australia, a biological control program was successful in controlling rush skeletonweed in cultivated wheat lands, and over most of its range. The same biological control agents were released in the Pacific Northwest, offering some control. The interior areas of Oregon, Washington, Idaho and Montana, with their cooler temperatures, do report the establishment of biocontrol agents. However, rush skeletonweed continues to spread through range and forested lands. In 1995, a program was implemented to research rush skeletonweed's native Eurasia for more effective biocontrol agents for these cooler climates (Markin and Quimby 1997).

Biological control agents released in Australia in 1971 included a gall midge (*Cystiphora schmidtii*), a mite (*Aceria chondrillae*) and a rust (*Puccinia chondrillina*). This rust, from southern Italy, effectively controls only the narrow-leaf biotype form of rush skeletonweed. This led to population increases of both the intermediate and broad-leaf forms of rush skeletonweed in Australia (Chaboudez 1994).

The gall midge (*C. schmidtii*) was introduced to California in 1975, and is established throughout the Pacific Northwest. The gall midge impacts the rosette and flowering stems of all biotypes in this region, and affected stands are often a noticeable purple to reddish color (Martin 1996; Rees et al. 1996).

The rust fungus, *P. chondrillina*, was introduced to Washington in 1978. The early-flowering rush skeletonweed biotype in Washington and Idaho, and the late-flowering biotype in Oregon are resistant to this rust (Martin 1996; Rees et al. 1996).

A gall mite (*Eriophyes chondrillae*) was introduced to Washington in 1979, and it is considered the most effective biological control agent available, to date. This mite is effective against all biotypes of rush skeletonweed. The visible impacts to flowering buds are leaf-like galls, up to 2" in diameter, which can reduce or prevent seed production. The gall mite also affects the roots carbohydrate reserves, preventing the formation of satellite plants. The seedlings and satellite plants often die. However, bud production is stimulated by the feeding mites (Prather 1993). Soil disturbance associated with cultivation in croplands interferes with the life cycle of the mite, and as a result, there is a reduction in the persistence of gall mite infestations to rush skeletonweed (Martin 1996; Rees et al. 1996). Rush skeletonweed often remains the dominant species in gall infested populations.

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* ***References available from the Washington State Noxious Weed Control Board Office in Kent.***

Rationale for Listing:

As a Class B noxious weed in Washington, the goal is to contain the existing populations of rush skeletonweed and prevent the further spread. Rush skeletonweed is a threat to irrigated lands of the Columbia Basin, to the sandy soils of dry land wheat areas and it is a threat to rangelands.

Initially rush skeletonweed spreads by seed, with the ability to travel long distances on wind currents. It spreads from roadside to croplands when the plant is mechanically injured. Once established in wheat-fallow systems, cultivation is the major factor of spread, and control is no longer feasible. Crop yields are reduced, and grain harvest is difficult due to the latex sap. Rush skeletonweed biotypes adapt to outcompete beneficial species for limited resources, including moisture and nitrogen. The biological control agents are very specific to plant biotypes, making long term biocontrol programs difficult to manage.